

How Much Noise is too Much?

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Key Points

- **Due to the new CISPR22 conducted emission requirements for Information Technology Equipment, noise in the 150 kHz to 30 MHz range will be a new problem to be faced due to the DTE switching power supply**
 - CISPR22 conducted emissions on the data cable will become mandatory on Aug. 1, 2001
- **Sending DTE power on the “spare pair” is less risky**
 - if a port passes CISPR22 conducted emissions, it is unlikely that it will degrade 10/100/1000 link performance
 - We probably do not have to closely specify pair to pair noise, since meeting CISPR22 is much more demanding
- **Sending DTE power on the “signal pair” has less margin, but can work**
 - It is quite feasible to provide for noise which is low enough to avoid 10/100/1000 performance degradation, and also pass CISPR22 conducted emissions
 - We need to specify the pair to pair output noise to make sure that the 10/100/1000 performance is not degraded

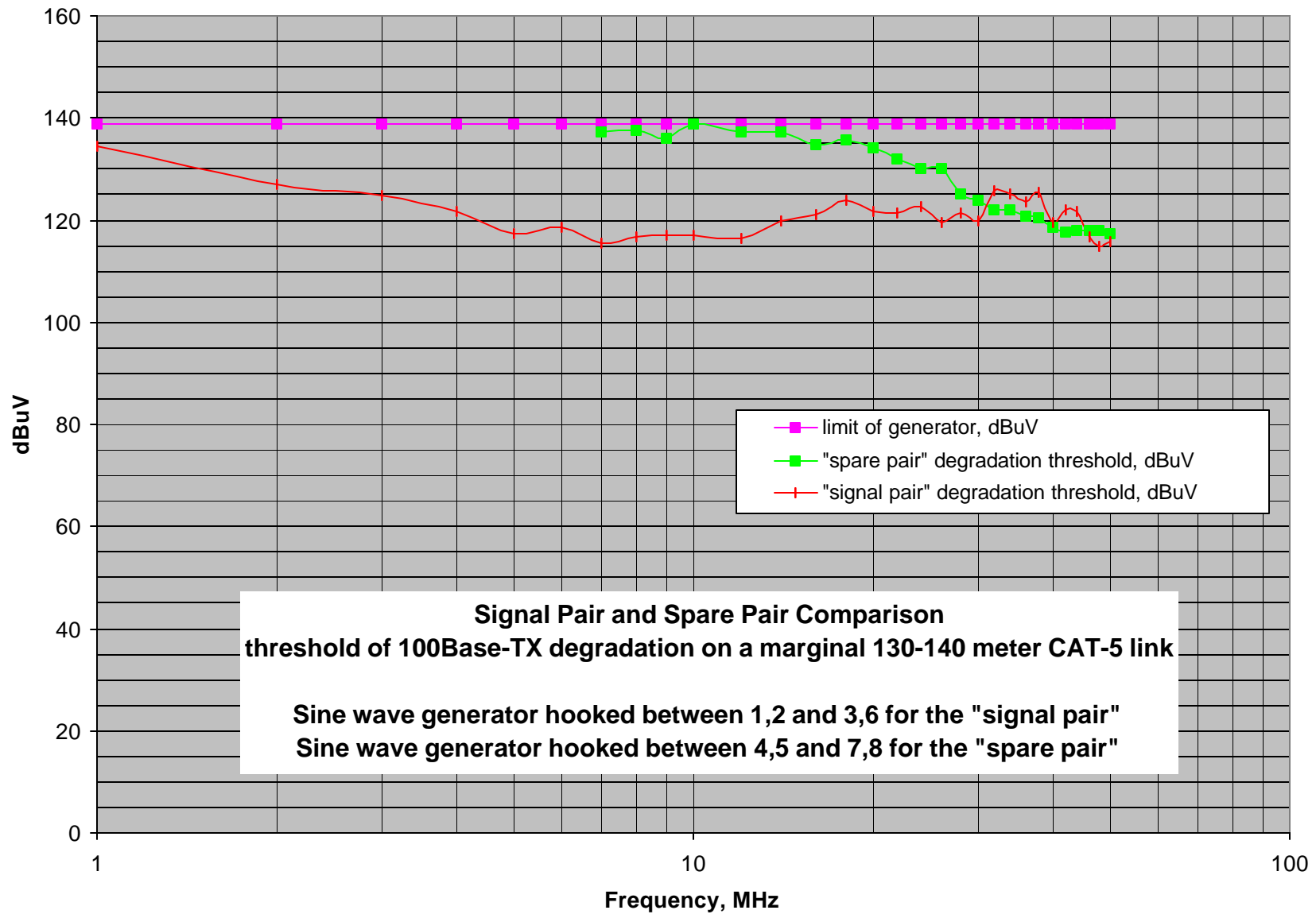
Noise, what is it, and what are the primary sources?

- **What is noise?**
 - working definition: any signal that is not wanted but cannot be completely avoided
 - an unwanted signal that causes a potential loss of money
 - degraded link or discovery performance
 - regulatory problem, can't ship a product
- **There are two main sources of noise in the DTE power application**
 - PHY and clock based noise from the logic area of the board, mostly common mode
 - The DTE power supply, which has both pair to pair mode noise, and common mode noise
- **DTE Power Supply Noise is (or will be) the biggest problem**
 - It is connected directly to the wire
 - It is not pure DC
- **The DTE power supply will be a switcher, the economics demand it**
 - switchers are guaranteed to be noisy, FET switching times, diode forward and reverse recovery, etc...
 - It will cost money to clean up (purify) the "DC" power, by using filters, etc...

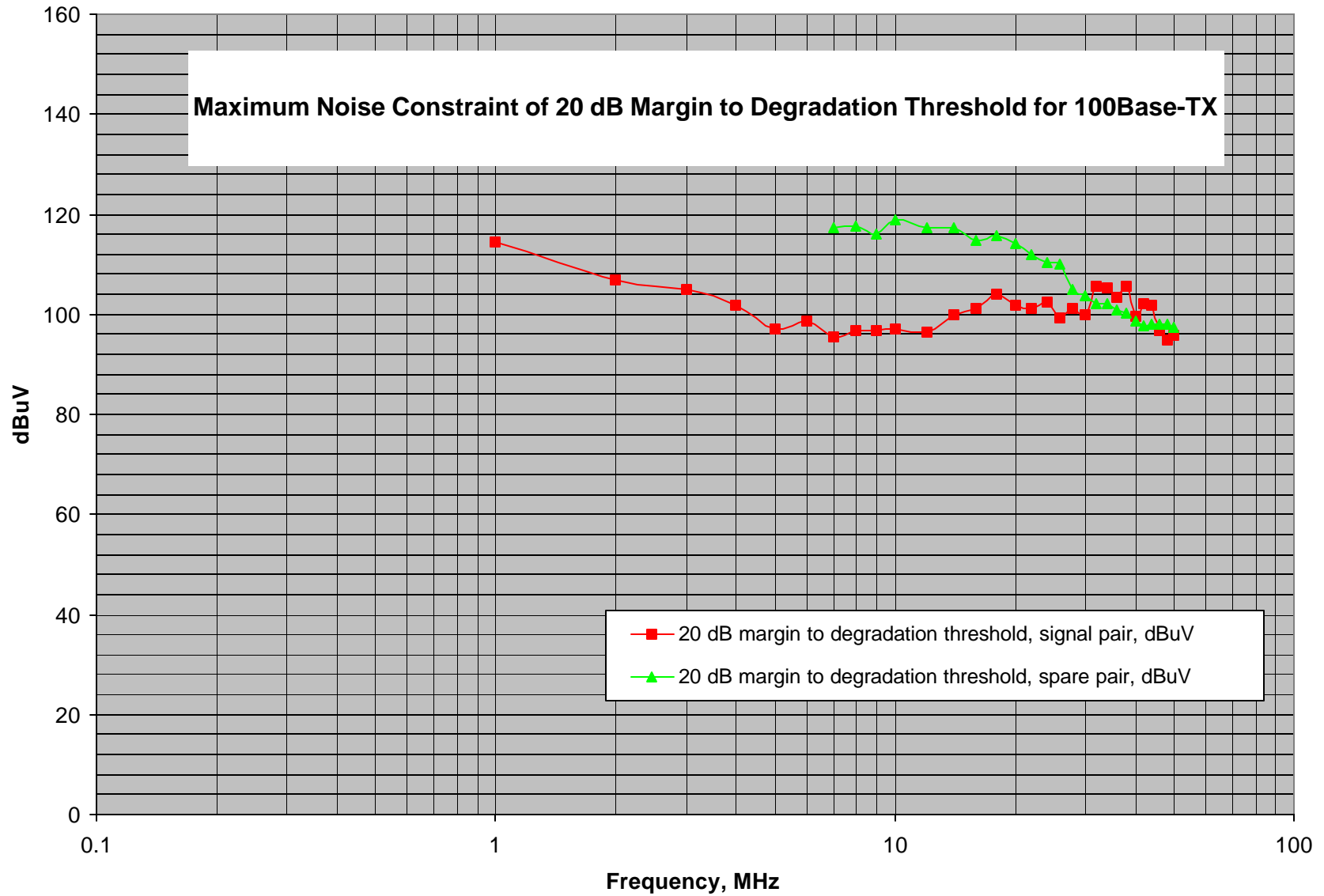
Noise Constraints, Link Degradation

- **The first goal is to not measurably affect 10Base-T, 100Base-TX, or 1000Base-T**
 - the impairment can be caused by
 - common mode to differential mode coupling
 - pair to pair mode to differential mode coupling
 - impairment is generally worse at long cable lengths
 - a test was run using a long CAT-5 cable set, at 130 to 140 meters, using 100Base-TX
 - the 100 Mbps full duplex link was producing some CRC errors in both directions without any pair to pair signal applied
 - the pair to pair mode sine wave signal was applied, and the signal level was recorded where the link error rate started to rise. I counted the number of errors that occurred in a 10 second interval.

Comparison of Interference on the Signal and Spare Pairs - Three Fingers



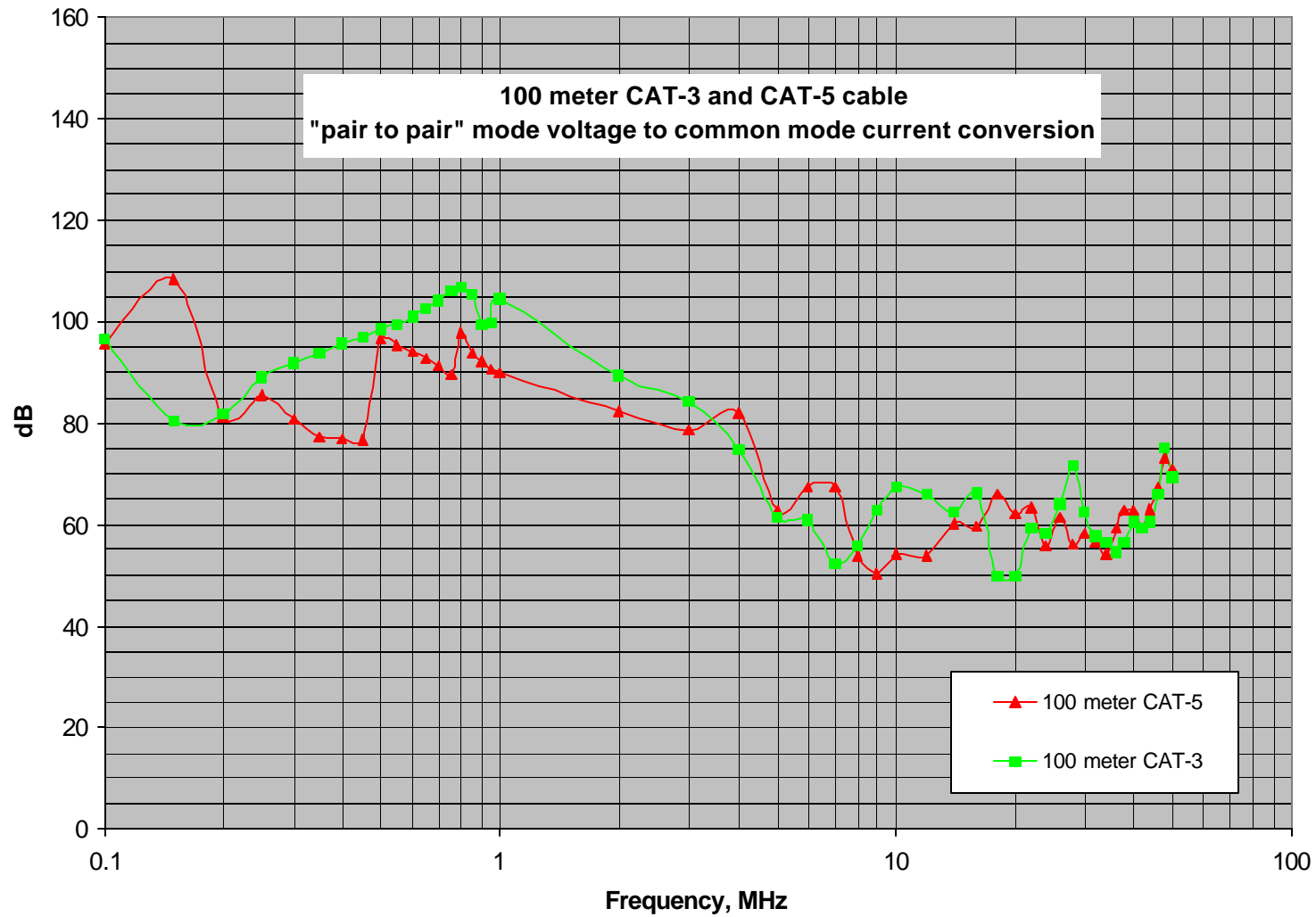
Noise Constraints on 100Base-TX Degradation with a 20 dB Margin



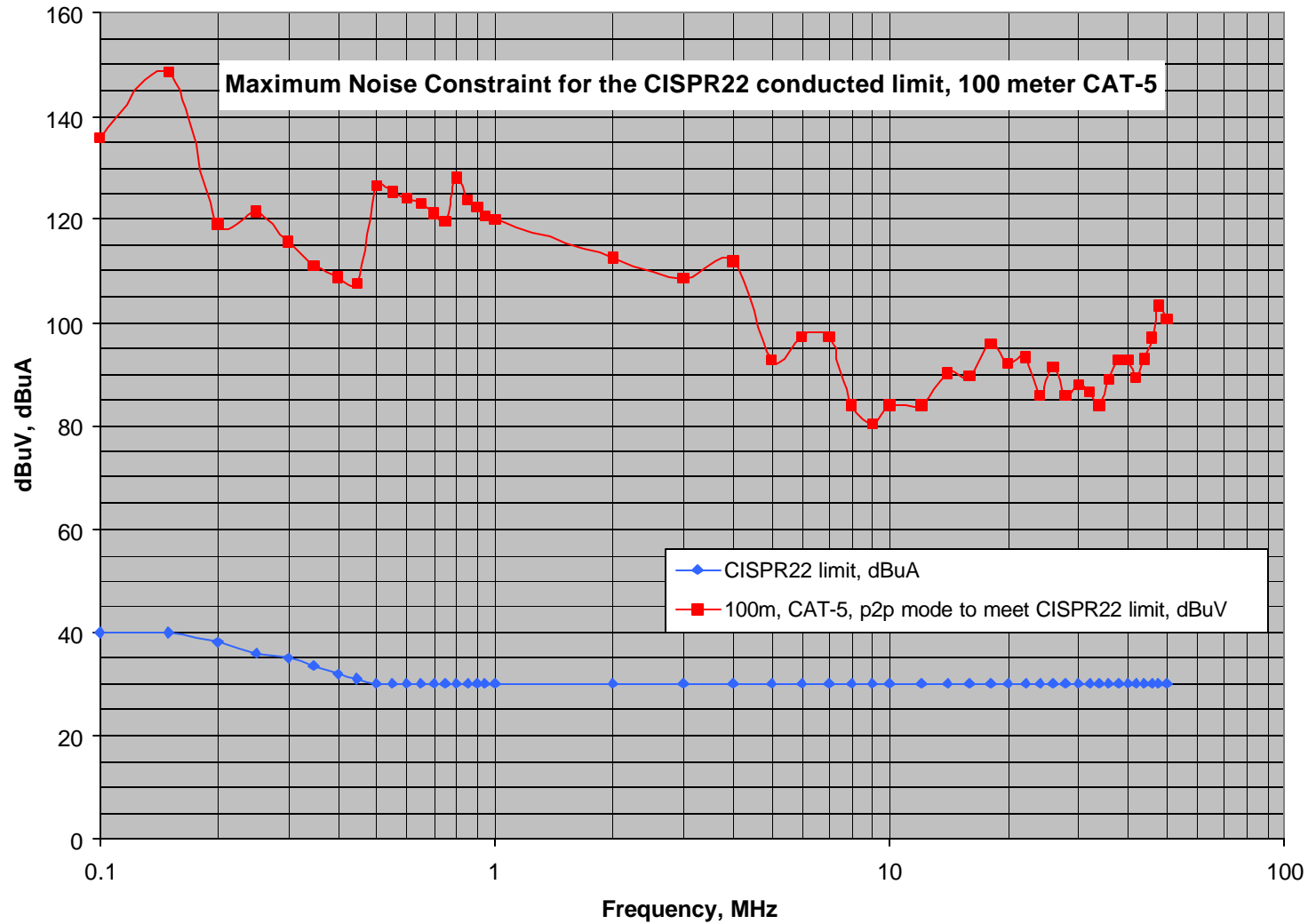
Noise Constraints, Cable Emissions

- **The second goal is to be able to meet regulatory requirements for a “world wide” standard**
 - There are existing regulatory constraints on radiated emissions above 30 MHz
 - FCC, CISPR, etc...
 - There are new regulatory constraints on conducted emissions on the data cable that cover the frequency range of 150 kHz to 30 MHz
 - these new conducted tests become mandatory on Aug. 1, 2001, per CISPR22, Information Technology Equipment
 - First, we look at how the UTP cables couple from the “pair to pair” mode into the common mode

Pair to Pair Mode Conversion to the Common Mode, CAT-3, CAT-5

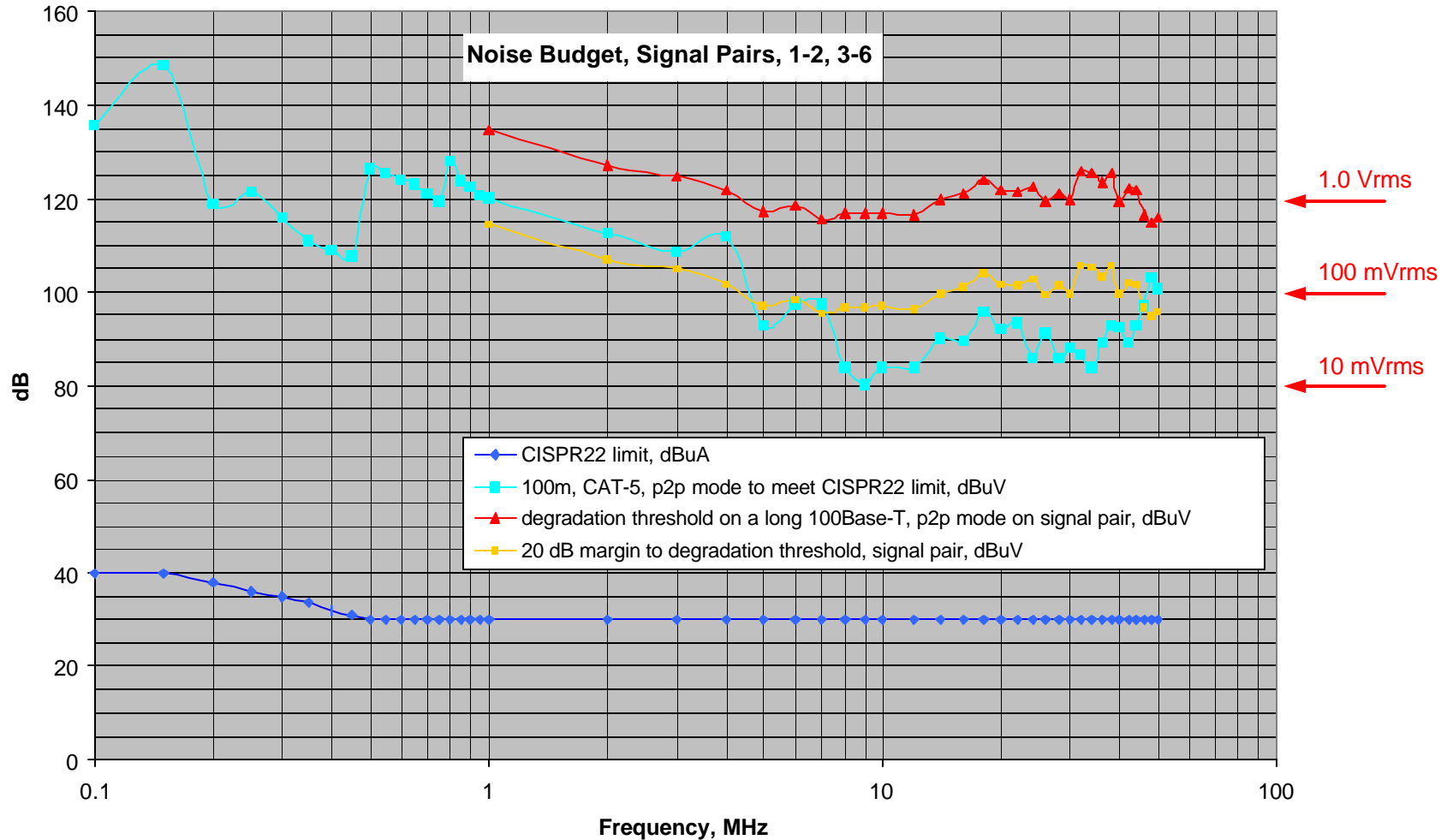


Pair to Pair Noise Constraint for CISPR22 Common Mode Limit



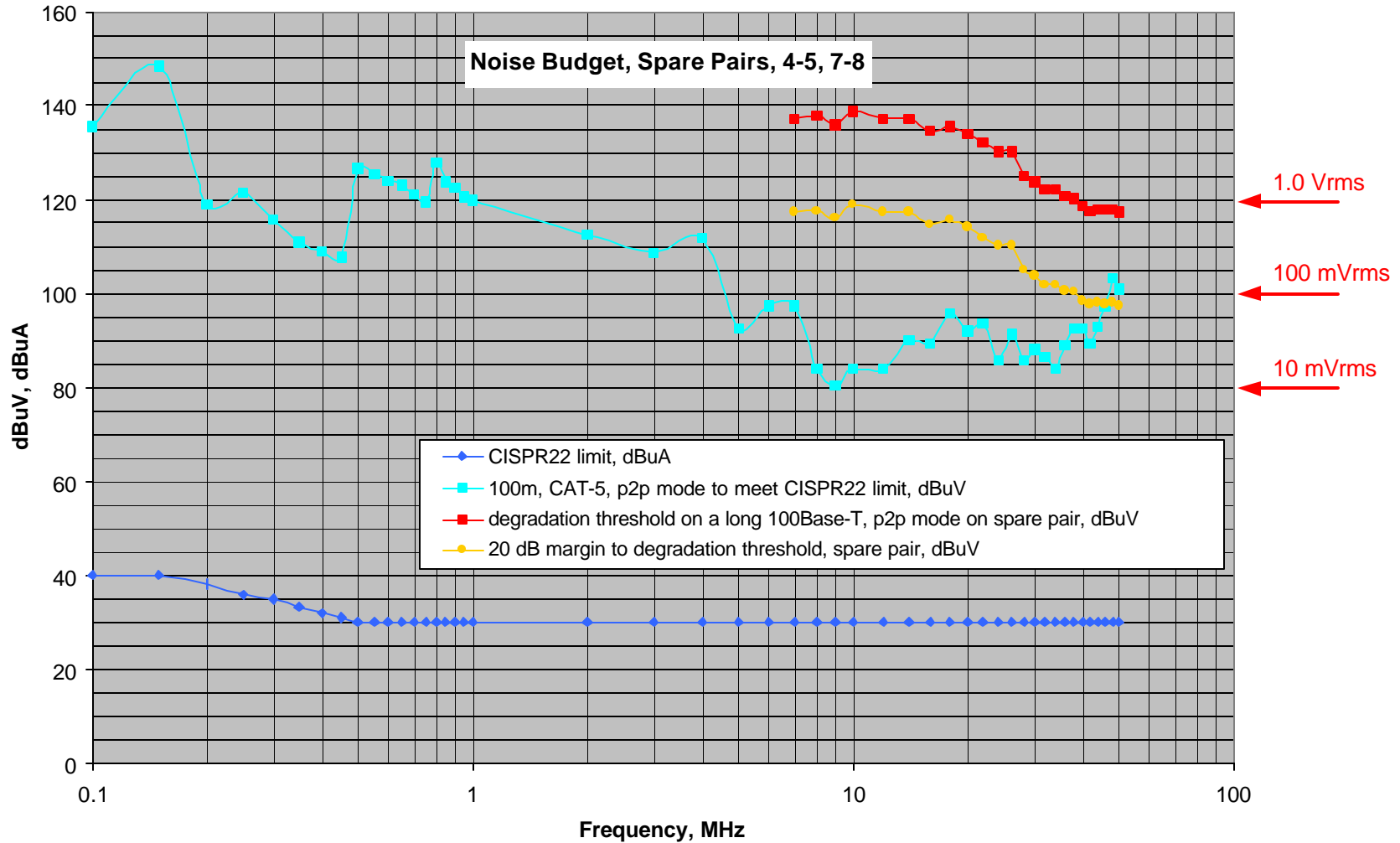
Noise Budget for DTE Power on the "signal" pairs

- In this case, meeting CISPR22 may not provide enough margin to keep from affecting the data



Noise Budget for DTE Power on the "spare" pairs

- In this case, meeting CISPR22 will probably also mean that the 10/100 data is not affected



Summary of Pair to Pair Mode Noise Budget

- Due to the new CISPR22 conducted emission requirements for Information Technology equipment, noise in the 150 kHz to 30 MHz range will be a potential problem due to the DTE switching power supply
- Sending power on the “spare” pair is less risky than the “signal” pair
- Sending power on the “signal pair” has less margin, but can work if the noise is controlled, i.e. a filter
- I have not included power supply produced common mode noise. This must be controlled, and will be the same on either pair.
- I propose to specify the maximum “pair to pair” mode noise, from either a PSE, or a PD port, to be a maximum of 80 to 90 dB μ V (10 mV rms to 32 mV rms) from 1 MHz to 30 MHz, as a starting point